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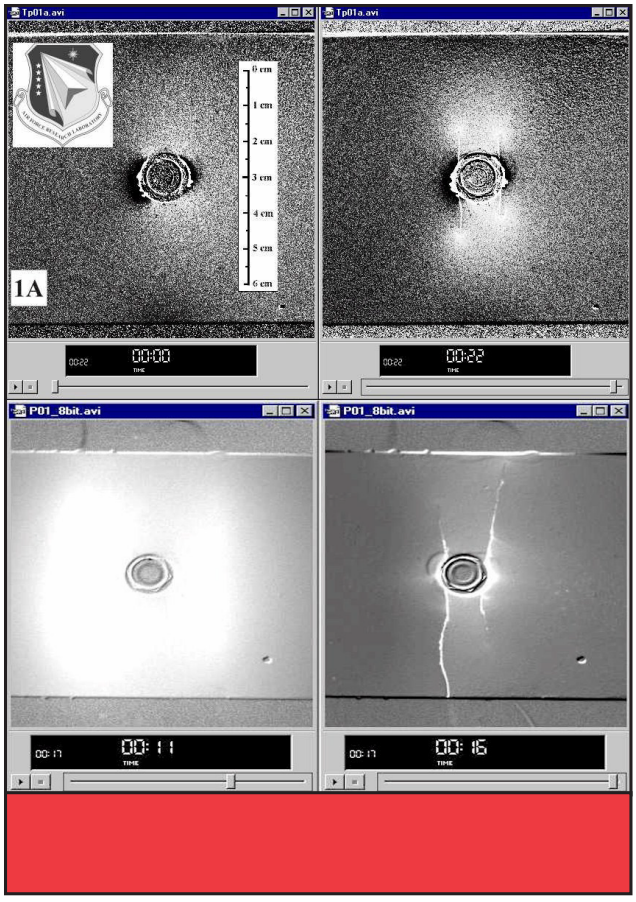
Success Story

VISUAL CRACK MEASUREMENT SYSTEM



Structural failures in secondary structures plague aging US Air Force aircraft. The Visual Crack Measurement System (VCMS) allows researchers to view the crack growth in those structures relative to vibration. This research is invaluable to the fleet of Air Force aging aircraft. VCMS is useable on composite, as well as aluminum, structures and opens the door for commercial applications.

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Accomplishment

The Air Vehicles Directorate successfully developed the VCMS, which uses temperature sensitive paint (TSP) to view and measure cracks on a vibrated structure. The VCMS records the images of fatigue-induced crack growth using a digital camera on a personal computer. This is the first time researchers obtained plots of crack length versus cycles for vibrating plates.

Background

A major issue for aging aircraft is structural failure in secondary structures. Cracks appear in secondary structures due to turbulent aerodynamic flow, exhaust flow, and high acoustic environments. The directorate developed a way to reliably slow or stop the crack growth through bonded composite repairs with added damping to reduce the vibrations that cause the stresses that, in-turn, cause the cracks. However, knowing where and when to place the repair on a secondary structure remained an issue.

Directorate researchers resolved that issue through successful use of the VCMS. They conducted an experiment to assess the reduction in fatigue crack growth in secondary aircraft structures with and without bonded damped fiberglass repair patches. Researchers used eight completely cracked plates to determine the effects of no patching. They used another 12 plates, cracked to a length of approximately 25 mm, and tested them with patches of structural adhesive, visoelastic material, and fiberglass. The researchers then used VCMS and TSP to observe crack growth.

Air Vehicles
Emerging Technologies

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTT, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (01-VA-07)